



**[4910-13]**

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**Office of Commercial Space Transportation;**

**Amended Waiver for Launch and Mission Risk**

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Notice of amended waiver.

**SUMMARY:**

This notice concerns an amendment to a waiver related to the launch and reentry of an Orion Multi-Purpose Crew Vehicle. On March 10, 2014, the FAA issued United Launch Alliance (ULA) and Lockheed Martin (Lockheed) waivers to certain risk requirements of the FAA's regulations. Since that time, changes to the mission's flight plan have increased its risk profile. After analyzing this updated risk profile, the FAA finds that the analysis underlying the original waiver decisions still applies. The FAA, therefore, amends its original waiver to permit launch risk from debris of  $217 \times 10^{-6}$  and total mission risk from debris of up to  $218 \times 10^{-6}$ .

**FOR FURTHER INFORMATION CONTACT:**

For technical questions concerning this waiver, contact Charles P. Brinkman, Aerospace Engineer, AST-200, Office of Commercial Space Transportation (AST), Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591; telephone (202) 267-7715; email: [phil.brinkman@faa.gov](mailto:phil.brinkman@faa.gov). For legal questions concerning this waiver, contact Benjamin Jacobs, Attorney-Advisor, Regulations Division (AGC-210), Office of the Chief Counsel, Federal Aviation Administration, 800 Independence

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## **SUPPLEMENTARY INFORMATION:**

### **Background**

Lockheed and ULA are private commercial space flight companies. Lockheed entered into a contract with the National Aeronautics and Space Administration (NASA) to provide the first orbital flight test for NASA's Orion Multi-Purpose Crew Vehicle (Orion) Program. Lockheed has contracted with ULA to provide launch services for the mission.

The FAA is responsible for licensing, among other things, the launch of a launch vehicle and the reentry of a reentry vehicle, under authority granted to the Secretary of Transportation by 51 USC Subtitle V, chapter 509 (Chapter 509), and delegated to the FAA's Administrator and Associate Administrator for Commercial Space Transportation.

The mission at issue in this notice is Orion Exploration Flight Test 1, which is scheduled to launch from Cape Canaveral Air Force Station in Florida in early December. The mission tests the Orion Multi-Purpose Crew Vehicle in an un-crewed, limited-capability configuration, and serves as a stepping stone towards a crew-capable vehicle that would enable human exploration missions beyond Earth orbit. The mission is comprised of a launch, which is conducted by ULA, and a reentry, which is conducted by Lockheed. The launch vehicle is ULA's Delta IV Heavy launch vehicle, which consists of a Common Booster Core (CBC) as the first stage with two additional strap-on CBCs and a Delta IV Cryogenic Second Stage (DCSS). The first burn of the DCSS places the Orion and the DCSS in orbit, and a second DCSS burn places the Orion into a highly

elliptical, negative-perigee trajectory, to simulate the thermal conditions and high reentry speeds the module would experience returning from missions beyond Earth orbit. After separating from the DCSS, the Orion module reenters over the eastern Pacific Ocean, splashing down 231 nautical miles west of Baja California, Mexico.<sup>1</sup>

Section 417.107(b)(1) of Title 14 of the Code of Federal Regulations (14 CFR) prohibits, in relevant part, the launch of a launch vehicle if the expected casualty ( $E_c$ ) rate for the flight exceeds  $30 \times 10^{-6}$  for impacting inert and explosive debris (debris). Section 435.35 establishes acceptable risk for reentry vehicles, and requires operators to comply with §§ 431.35(a) and 431.35(b)(1)(i)<sup>2</sup>, which in turn prohibit an  $E_c$  for debris in excess of  $30 \times 10^{-6}$  for both launch and reentry combined.

On February 27, 2014, ULA petitioned the FAA for waivers of these provisions because the projected risk from debris during launch was  $164 \times 10^{-6}$ , and the projected risk from debris during reentry was less than  $1 \times 10^{-6}$ —for a total-mission debris risk of approximately  $165 \times 10^{-6}$ . The FAA issued a waiver and, on March 10, 2014, gave notice in the *Federal Register*. *Notice of Waiver*, Mar. 10, 2014 (79 FR 13375). This initial waiver allowed a maximum-allowable  $E_c$  value for ULA and Lockheed’s proposed mission of  $165 \times 10^{-6}$ ,<sup>3</sup> based on the risk increase the launch operators requested.

On November 3, 2014, ULA and Lockheed transmitted to the FAA the mission’s final trajectory and an updated risk analysis. Since that time, ULA and Lockheed have

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<sup>1</sup> We note that, due to the unique characteristics of this mission, FAA regulations require us to account for risks that are typically not included in our § 417.107 analysis—namely, the uncontrolled reentry of an upper stage after orbital insertion.

<sup>2</sup> Although the module is a reentry vehicle and not a reusable launch vehicle, 14 CFR § 435.33 incorporates and applies § 431.43 to all reentry vehicles.

<sup>3</sup> Our March 2014 Notice correctly identified the total mission debris risk as  $165 \times 10^{-6}$ , but when breaking down the sources of that risk, we listed four risk factors adding up to a total of only  $164 \times 10^{-6}$ . 79 FR at 13376. This breakdown mistakenly omitted the debris risk related from controlled disposal of the upper stage, with an  $E_c$  of  $< 1 \times 10^{-6}$ .

continued to submit updated risk information, as it becomes available, to the FAA. According to these documents, it is necessary for ULA and Lockheed to modify the mission's launch trajectory, for two reasons: to lower the mission's maximum heating temperature constraint, and to adjust the flight azimuth to be the same as what was flown in previous missions. On November 20, 2014, in light of the changed mission trajectory, ULA petitioned for an amendment to its waiver to allow an  $E_c$  of  $207 \times 10^{-6}$  for debris from launch. On November 21, 2014, Lockheed petitioned for an amendment to its waiver to allow total mission risk of  $208 \times 10^{-6}$ .

Using ULA's updated trajectory, the FAA calculates the debris-related  $E_c$  for failure during the de-orbit burn, after the first 120 seconds, increases to  $76 \times 10^{-6}$  from  $53 \times 10^{-6}$ . In addition, calculations by the FAA and the United States Air Force indicate an increased debris risk, from launch to orbital insertion, of approximately  $30 \times 10^{-6}$  above original estimates. As a result, the FAA calculates that overall launch risk increases from  $164 \times 10^{-6}$  to  $217 \times 10^{-6}$ , and total mission risk increases from  $165 \times 10^{-6}$  to  $218 \times 10^{-6}$ . The FAA believes these risk figures best capture the uncertainties due to weather and the inability to perform significant mitigation at the launch site on the day of launch.

#### **A. Analysis of the Updated Risk Assessment**

The FAA's original waiver analyzed ULA and Lockheed's proposals using the waiver criteria established by our statutory and regulatory framework. Section 50905(b)(3) allows the FAA to waive a license requirement if the waiver (1) will not jeopardize public health and safety, and safety of property; (2) is in the public interest;

and (3) will not jeopardize national security and foreign policy interests of the United States. *See also* 49 CFR 404.5(b). We reapply those same criteria here.

### **1. Public Health and Safety, and Safety of Property**

The FAA's initial waiver examined ULA and Lockheed's proposal in comparison with the historically acceptable launch risk levels at other Federal agencies to determine whether the mission would fall within those parameters. The rationale for our approval of ULA and Lockheed's prior waiver requests applies equally to their revised risk assessment. Although the FAA's regulations prohibit debris risk in excess of  $30 \times 10^{-6}$ , a waiver is warranted in this case because the United States Government's experience conducting other space missions with risk in excess of  $100 \times 10^{-6}$  demonstrates that the risks of this mission are consistent with the public health and safety, and the safety of property. As we stated in our March 10, 2014, *Notice of Waiver*, the United States Government has repeatedly accepted risk for government launches in excess of the FAA's  $30 \times 10^{-6}$ , without negative consequences for safety. 79 FR at 13376. The Space Shuttle, for example, used a debris risk criterion of  $200 \times 10^{-6}$  for launch risk to the public. *See* NASA's Implementation Plan for Space Shuttle Return to Flight and Beyond, Vol. 1 Final Edition, at 2-39 (May 15, 2007). In addition, in 2005, the U.S. Air Force accepted risk levels in a government launch ranging from 145 to  $317 \times 10^{-6}$ . Dept. of the Air Force Memorandum, Overflight Risk Exceedance Waiver for Titan IV B-30, Mission (Apr. 4, 2005).

ULA's updated launch risk of  $217 \times 10^{-6}$  is still less than the risk levels previously approved for a government launch. Accordingly, granting a waiver of §§ 417.107(b)(1)

and 431.35(b)(1)(i) in this case does not jeopardize the public health and safety, or the safety of property.

## **2. Public Interest**

The FAA looks to its enabling statute to determine how Congress has defined the public interest. The FAA implements the agency's statutory mandate to encourage the development of commercial space capabilities and the continuous improvement of the safety of launch vehicles designed to carry passengers. 51 U.S.C. § 50901(b).

As with their initial petition, ULA and Lockheed's petition for an amended waiver are consistent with the public interest because the test flight is necessary to the development of NASA's human-missions capability beyond Earth orbit.

## **D. National Security and Foreign Policy Interests**

The FAA has not identified any national security or foreign policy implications associated with amending this waiver.

## **Summary and Conclusion**

The FAA determines that amending the waivers associated with this mission will not jeopardize public health and safety or safety of property. In addition, amending the waivers is in the public interest because it accomplishes the goals of Chapter 509 and does not unduly increase risk to the public. Finally, amending the waivers will not jeopardize national security and foreign policy interests of the United States. The FAA therefore amends its prior waivers of the requirements of 14 C.F.R. §§ 417.107(b)(1) and

431.35(b)(1)(i) for launch and mission risk, respectively, to allow launch risk of an  $E_c$  of  $217 \times 10^{-6}$  and total mission risk of  $218 \times 10^{-6}$ .

Issued in Washington, DC on November 26, 2014.

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